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# UNIVERSITY of PITTSBURGH BULLETIN

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## SCHOOL OF MINES

1920-1921



### PRELIMINARY ANNOUNCEMENT

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#### ANNOUNCEMENT SERIES

Vol. 16

MAY 11, 1920

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## 1920-21

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September 20-21..... Monday-Tuesday—Registration for Freshmen.  
September 22-23..... Wednesday-Thursday—Registration for Sophomores and Juniors.  
September 24..... Friday—Registration for Seniors.  
September 27..... Monday—First Semester Begins.  
December 20..... Monday—Christmas Vacation Begins.  
January 1..... Saturday—Christmas Vacation Ends.  
January 3..... Monday—Classes Resume Work.  
February 5..... Saturday—First Semester Ends.  
February 7-9..... Monday-Wednesday—Second Semester Registration.  
February 10..... Thursday—Second Semester Work Begins.  
March 21-26..... Monday-Saturday—Easter Recess.  
March 28..... Work Resumed.  
May 27..... Senior Work Ends.  
May 30- June 4..... Comprehensive Examination for Seniors.  
May 30-June 18..... Field Trips.  
June 11..... Saturday—Second Semester Ends.  
June 12..... Sunday—Baccalaureate Sermon.  
June 15..... Wednesday—Commencement.  
June 20..... Summer Courses in Surveying Begin.  
August 27..... Summer Courses in Surveying End.

## OFFICES AND OFFICE HOURS

Office, School of Mines Building, Upper Campus. Consultation hours: 9:00 A.M. to 5:00 P.M.

General Office, State Hall. Telephone, Schenley 3300.

For catalogs and other information, address the Registrar of the University, Bigelow Boulevard.

## ADVISORY BOARD

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J. LAUER STAUFF, Assistant in Surveying.

Members of faculties of other Schools in the University giving instruction to School of Mines students are listed in the outline of courses.

## LOCATION

The School of Mines is located on the upper campus. Persons desiring to reach the School from down town or East Liberty should use the Center Avenue (Lincoln) car line to Center Avenue and Allequippa Street.

## SPECIAL ADVANTAGES

The location of Pittsburgh, in the very heart of the bituminous coal fields of the Appalachian system, and in the most richly productive oil fields of Western Pennsylvania, with the great concentration here of mining, metallurgical and petroleum interests, makes this undoubtedly one of the most advantageous points in the United States for a school of this character.

It is also conveniently located with reference to the bituminous coal fields of Ohio and West Virginia, the anthracite fields of Eastern Pennsylvania, and the Lake Superior iron and copper regions.

## BUILDINGS

The School occupies remodeled buildings formerly used by the Students Army Training Corps. These consist of one building 314 feet by 65 feet, in which are the laboratories for Mining, General Metallurgy, the Metallurgy of Iron and Steel, Ore Dressing and Fire Assaying; two buildings adjoining, each 50 feet by 65 feet, containing four large classrooms; and a two-story building 152 feet by 40 feet containing the drafting room, the laboratories of Geology, Mineralogy, Petrography, Petroleum Engineering, and four classrooms.

## EQUIPMENT

### LABORATORIES IN THE SCHOOL OF MINES

I. THE MINERALOGICAL AND GEOLOGICAL LABORATORIES. Their equipment is exceptionally complete, the laboratories ranking among the best in the country. Included are:

THE SMITH CABINET. This collection was formed by the two sisters whose name it bears, and is rich in mineralogical and zoological specimens.

MINERALOGICAL COLLECTIONS. In addition to the Smith Collection there is a systematic, labelled collection of 3,500 specimens, numerous smaller sets illustrative of physical properties, crystallization, etc., and large amounts of exceptionally rich material for student use and identification. For crystallography there are large collections of small wooden models, and larger wooden, glass and pasteboard models for lecture use, as well as the latest instruments for crystal measurement.

PETROGRAPHICAL LABORATORY. This contains about 10,000 rock specimens and 5,000 thin sections for microscopic study, 10 petrographic microscopes and a number of the instruments used in more advanced optical mineralogy.

THE GEOLOGICAL LABORATORIES are equipped with numerous collections illustrative of geological phenomena, geologic maps and government reports, collections of fossils, models illustrating structural geology, etc., while through the courtesy of the Director and Trustees of the Carnegie Museum, with part of the staff, opportunity is afforded for the study of the excellent paleontological collections of the Carnegie Museum.

ECONOMIC GEOLOGY LABORATORY. The collection of material illustrative of Economic Geology includes suites of ores from most of the prominent mining districts, and suites of specimens of the more important non-metallic minerals, such as coals, building stones and clays.

2. THE FIELD-INSTRUMENT EQUIPMENT includes a large assortment of the various types and makes of instruments used in land surveying, railroad surveying, construction work, leveling, geodetic surveying and mine surveying. The instruction of the student in the care, adjustment and use of the various types of instruments has been kept clearly in mind and well provided for in the selection of equipment.

3. THE MINING LABORATORY is equipped with models illustrating the principal systems of mining, hoisting, haulage, etc.; hand drills, breast drills, rock drills, coal-mining machines, miners' lamps (including electric lamps), apparatus for testing safety lamps, working model of mine fan, instruments for measuring the velocity of air currents, etc. Air and electricity are directly available as power, there being in the laboratory an air compressor and receiver, and a switchboard and complete wiring.

4. METALLURGICAL ANALYTICAL LABORATORY. This is equipped for metal, slag, etc. analysis, and for electrolytic experiments in metal plating and refining. Large laboratory tables with individual lockers are provided, a good hood, storage batteries, and the necessary electric meters for control. The stock room is conveniently available to the student.

The equipment for METALLOGRAPHY includes the necessary microscopes and photographic apparatus. The grinding and polishing apparatus and equipment for thermal analysis are located in an adjacent room. The dark rooms are suitably equipped and well ventilated.

The physical testing equipment of the School of Engineering is available for students in the School of Mines.

There is available for the laboratory study of IRON AND STEEL, equipment for microscopic and thermal analysis, the furnace laboratory for heat treatment, the forge shop, and the electric furnaces for making up special heats. Much of the equipment is particularly chosen to meet the needs of this work.

For the electric furnace work some 150 amperes of direct current is available from the University power plant; also some 600 amperes of alternating current from the Duquesne Light Company's lines which can be transformed to any desired voltage up to 220 volts.

5. FURNACE LABORATORY. This laboratory is provided with assay furnaces and melting furnaces using both coke and gas for fuel; equipment for roasting and sintering, with tools, pyrometers, etc. Individual lockers are furnished students for special equipment.

6. ORE DRESSING LABORATORY. This laboratory is designed to illustrate the principles of crushing, screening, classification and concentration of ores, and of allied metallurgical processes, such as amalgamation, cyanidation and leaching.

A crushing and grinding equipment reduces ores from pieces 5 inches in diameter to pass 100 mesh screen.

Sizing and classifying apparatus is represented by several types. Small jigs, laboratory and half-size concentrating tables of different makes are provided, also slime tables and a well-equipped flotation laboratory, with supply of ores, oils, etc.

Cyanidation and other hydrometallurgical work are provided for by both leaching and agitating tanks, pressure and vacuum filters, etc.

7. THE OIL AND GAS LABORATORY is equipped with apparatus for experimental work in connection with the course in Petroleum Engineering, as well as for original research.

## OTHER LABORATORIES USED BY STUDENTS OF THE SCHOOL OF MINES

THE CHEMICAL LABORATORIES in the School of Chemistry.

THE PHYSICAL LABORATORIES in the College.

THE STEAM LABORATORY, ENGINE AND POWER LABORATORY, MATERIALS TESTING LABORATORY, HYDRAULIC LABORATORY, and THE ELECTRICAL ENGINEERING LABORATORIES in the School of Engineering.

THE PITTSBURGH EXPERIMENT STATION OF THE UNITED STATES BUREAU OF MINES, for the investigation of mine explosions and other factors relating to mining. Its work is available for the students, who are taught there: First Aid to the Injured and Mine Rescue Work, receiving certificates therefor from the United States Government and the American Red Cross.

## LIBRARY FACILITIES

THE LIBRARY. The total number of volumes in the University Library is about 24,000. A Reading Room is maintained in connection with the School, and is well supplied with the leading technical periodicals.

THE CARNEGIE LIBRARY, with its immense collection of scientific books and periodicals, is near the University, and all of the files and collections are available for the use of students.

## REQUIREMENTS FOR ADMISSION

All candidates for admission to the School of Mines must be at least seventeen years of age and furnish testimonials of good moral character. Those who come from other institutions must present certificates of honorable dismissal.

## APPLICATION FOR ADMISSION

As soon as you have reached a decision to enter, send to the Registrar, Room 109, State Hall, for an Application Blank. Fill in this blank as soon as it is received and mail it to the Registrar, who will send for your high school record and advise you of admission possibilities.

## METHODS OF ADMISSION

I. CERTIFICATES OF THE COLLEGE ENTRANCE EXAMINATION BOARD and of the NEW YORK REGENTS are accepted in lieu of entrance examinations at the University.

For information concerning the dates upon which the examinations of the College Entrance Examination Board are to be held, address The Registrar of the University of Pittsburgh.

II. CERTIFICATES FROM ACCREDITED SCHOOLS. Instead of examination, certificates from high schools and academies whose work has been approved by the University as being equivalent to that required for admission to the freshman class, will be accepted. The official blank provided by the University should be used. It may be obtained upon application to the Registrar or Dean.

III. FROM OTHER COLLEGES. Students from other institutions having entrance requirements equivalent to those of the University of Pittsburgh and offering equivalent courses of study, will be given provisional credit for the work done and admitted to advanced standing without examination. If their work proves satisfactory, the provisional credits will be made permanent.

## EXPLANATION OF REQUIREMENTS FOR ADMISSION

The University sets no time at which it will offer regular scheduled examinations for admission. This may be arranged if occasion arises. The practical agreement of High School courses in general with the list of subjects allowed for entrance makes such examination for the most part unnecessary.

For admission to the School of Mines the student who is a candidate for a degree must offer fifteen units, a unit being the equivalent of four recitations a week of one hour each for one year, or five recitations of three-quarters of an hour each.

The units are as follows for 1920:

English, 3 units.

Algebra,  $1\frac{1}{2}$  units.

Plane and Solid Geometry,  $1\frac{1}{2}$  units.

History, 1 unit.

Language, other than English, 2 units.

Physics, 1 unit.

Five additional units must be offered from the approved list, which includes Latin, Greek, Modern Languages, English, History, Civics,

Economics, Mathematics, General Science, Physiography, Drawing, Manual Training, Geology, Astronomy, Commercial Geography, Chemistry and Biology. In general, any subject given regularly in an approved high school and properly certified by the Principal will be accepted.

## CONDITIONS

No applicant with less than fifteen units will be admitted as a regular student. No conditions will be allowed except in specific subjects, in which there may be no more than two units. It is highly desirable that a student should enter without any conditions, but if they are allowed, they must be removed in part before the second year, and wholly before the third year.

## REGISTRATION

The office of the Registrar is in Room 109, State Hall. At this office all registration will be made directly.

All officers of instruction are required to follow the same rules, and under no circumstances may admit to a place upon their rolls the name of any student who has not a card, issued or authorized by the Registrar, in testimony of the fact that he has complied with all regulations, general and specific, both as to his admission and classification, and the payment of tuition or fees.

The office of the University Registrar is open throughout the year. Old students are required to renew their registration before the beginning of every semester, both at the opening of the school year and during the progress of the year.

A penalty of five dollars per semester for late registration is added to the semester bill.

## VACCINATION

The University requires for admission a certificate from a physician, stating that the student has been successfully vaccinated against smallpox or has had smallpox. This must be presented, properly filled out and signed, at the time of registration. In default of this, registration will not be permitted unless the student will submit to inspection or vaccination by the University Department of Health. This requirement is necessary to carry out the laws of the State of Pennsylvania and of the City of Pittsburgh as they refer to vaccination and school attendance. Blank forms of certificate issued by the University will be sent upon application to the Registrar.

## PHYSICAL EXAMINATION

New matriculates are required to have a physical examination made by the University Department of Health and this must be completed during registration week. Appointment for the time of this examination must be made at the time of registration. Students coming from out of town should be prepared to take the time for this examination on the day they register.

## TESTS FOR FITNESS

The Department of Psychology of the University conducts tests upon all incoming students, the object being to determine what may be expected of each, so that the student who is subnormal in any direction may be given proper assistance; or if he is not fitted to take the course in the School of Mines, that he may be advised to take up another line of study. In the case of the student who is abnormally bright, care may be necessary to see that he conserves his health by keeping within proper limits of study. These tests may be supplemented by medical examinations where indicated.

Special attention will be paid in the School to the development of character, initiative and leadership, which are of paramount importance in the profession.

## SCHOLARSHIPS

A limited number of scholarships, entitling the holders to a part or all of the tuition, are available in the School of Mines. For a list of these scholarships, and information concerning the conditions under which they are awarded, apply to the Secretary of the University.

## TUITION AND FEES

Tuition \$210.00, payable in two installments, \$110.00 first semester and \$100.00 second semester.

Summer Course in Surveying (1920) \$50.00, not including board.

The tuition for the first semester entitles the student to admission to all athletic events and certain other activities under the jurisdiction of the Advisory Board of Student Activities.

A charge is made for laboratory supplies and other materials used in courses requiring them. Coupon books costing \$5.00 each are provided for this purpose.

Late Registration Fee: A fee of \$5.00 is added to the tuition charge if registration is not completed within the dates specified.

Examination Fee: A fee of \$5.00 is charged for each examination for advanced standing without regard to the number of credits involved. The same fee is charged for every reexamination.

Graduation Fee: Due upon graduation, \$10.00 for each diploma.

The above figures do not include charges for books, instruments, etc.

## REFUNDS

No refund of tuition will be allowed if a student withdraws from a course after the middle of the semester. Application for refund will only be considered when made in writing at the time of withdrawal.

# OUTLINE OF COURSES

GROUP I—MINING.			GROUP II—METALLURGY			GROUP III—OIL AND GAS PRODUCTION.		
(a) General Mining and Metallurgy			Leads to Degree of Metallurgical Engineer (Met. E.)			(a) Leads to Degree of Petroleum Engineer (Pet. E.)		
(b) Coal Mining and Coking			Leads to Degree of Engineer of Mines (E. M.)			(b) Leads to Degree of Bachelor of Science in Petroleum Geology (B. S. in Pet. Geol.)		
Page	Course No.	Title	Class	Hours a Week		Prerequisite	Group	
				Lab.	Study Total		I-a	I-b III-a III-b
16	Psy. 1	How to Study	1	0	1	.....	x	x
16	En. 3	English	4	0	8	.....	x	x
16	En. 4	English	1	0	2	.....	x	x
16	M. Lang.	Ger., Fr. or Span.	3 or 5	0	6 or 10	En. 3; Psy. 1	.....	x
16	M. Lang.	Ger., Fr. or Span.	3 or 2	0	6 or 9	.....	Elective	.....
17	Math. 21, 22	Mathematics	6	0	12	.....	Elective	.....
17	Math. 21, 22	Mathematics	6	0	12	Math. 21, 22	x	x
17	Math. 23, 24	Math. and Mechanics	6	0	12	With Phys. 7, 8	x	x
18	Chem. 1, 2	Inorganic Chem.	4	6	4	.....	x	x
18	Chem. 21, 22	Qual. and Quant. Anal.	2	6	4	Chem. 1, 2	x	x
18	Chem. 30	Fuel Analysis	1	6	2	Chem. 21, 22	x	x
18	Chem. 39	Nat. Debris and Hydrocarbons	4	6	4	Chem. 1, 2	.....	x
19	Chem. 41, 42	Physical Chem.	2	3	4	Math. 21, 22	.....	x
19	Phys. 7, 8	Physics	4	3	6	Chem. 21, 22; Phys. 7, 8	.....	x
19	Ec. M-2	Prin. of Econ.	5	0	6	Math. 21, 22	x	x
19	Ec. M-3	Business Law	2	0	4	.....	x	x
19	Ec. M-4	Contracts and Spec.	2	0	4	Econ. M-2	x	x
20	Ec. M-5	Econ. of Mineral Technol.	5	0	6	Econ. M-3	.....	x
20	Ec. M-6	Econ. of Mineral Technol.	2	0	4	Econ. M-2	.....	x
20	Ec. M-8	Technical Writing	2	0	4	Econ. M-4	.....	x
20	Geol. 101, 102	Geol. Methods	2	3	4	.....	Elective	.....
20	Geol. 103, 104	Geol. Lab.	0	6	0	.....	Elective	.....
20	Pal. 1, 2	Paleontology	3	3	0	M. Geol. 2, 3, 5	.....	x
21	M. Geol. 2	Genl. Geology	3	3	6	Geol. 101, 102	.....	x
21	M. Geol. 3	Historical Geology	3	3	6	M. Geol. 3	.....	x
21	M. Geol. 5	Intro. Mineralogy	2	6	0	Chem. 1	x	x
21	M. Geol. 6	Mineralogy	3	6	0	M. Geol. 2	x	x
21	M. Geol. 8	Economic Geology	2	6	0	M. Geol. 2	x	x
22	M. Geol. 9	Ore Deposits	3	0	6	M. Geol. 5	.....	.....
22	M. Geol. 10	Geology of Coal	3	0	6	M. Geol. 2, 3, 5	x	x
22	M. Geol. 11, 12	Petrography	1	6	2	M. Geol. 8	.....	.....
22	M. Geol. 113	Adv. Mineralogy	.....	.....	.....	M. Geol. 6	.....	.....
						Elective	.....	.....
						Elective	.....	.....

Page	Course No.	Title	Class	Lab.	Study	Total	Sem.	Prerequisite	I-a	I-b	Group		
											II	III-a	III-b
22	M. Geol. 115, 116	Adv. Econ. Geol.	.....	.....	.....	.....	1, 2	M. Geol. 9	Elective	.....	.....	.....	.....
22	M. Geol. 117, 118	Foreign Mineral Deposits.	.....	.....	.....	.....	1, 2	M. Geol. 9	Elective	.....	.....	.....	.....
23	Gr. 1, 2	Engineering Drawing	.....	1	6	1	8	1, 2	With Math. 21, 22	.....	.....	.....	.....
23	Gr. 3	Graphic Statics	.....	1	6	1	8	1, 2	Math. 23, 24	.....	.....	.....	.....
23	Sur. 2	Elem. Mapping	.....	1	3	0	4	2	Phys. 7, 8; Gr. 1, 2	.....	.....	.....	.....
23	Sur. S-3	Genl. Surveying	.....	8 Weeks	.....	.....	.....	Sum.	Math. 21; Gr. 1	.....	.....	.....	.....
24	Sur. S-4	Railroad Surveying	.....	2 Weeks	.....	.....	.....	Sum.	Math. 21; Sur. 2	.....	.....	.....	.....
24	Sur. 6	Underground Surveying	.....	3 Weeks	.....	.....	.....	2	Sur. S-3	.....	.....	.....	.....
25	Sur. 7	Mine Mapping	.....	0	6	0	6	1	Sur. S-4	.....	.....	.....	.....
25	Sur. 8	Mine Mapping	.....	0	6	0	6	2	Sur. 6	.....	.....	.....	.....
25	Mine 1	Principles of Mining	.....	5	0	6	11	1	Sur. 7	.....	.....	.....	.....
26	Mine 2	Practice of Mining—Ore	.....	4	6	4	14	2	Math. 23, 24; Chem. 1, 2	.....	.....	.....	.....
26	Mine 3, 4	Practice of Mining—Ore	.....	4	9	4	17	1, 2	Phys. 7, 8; Mine 1	.....	.....	.....	.....
26	Mine 6	Practice of Mining—Coal	.....	4	6	4	14	2	Mine 2; Gr. 3	.....	.....	.....	.....
26	Mine 7, 8	Practice of Mining—Coal	.....	4	9	4	17	1, 2	Math. 23, 24; Chem. 1, 2	.....	.....	.....	.....
27	Mine 109, 110	Power Plant and Machinery	.....	3	6	4	13	1, 2	Phys. 7, 8; Mine 1	.....	.....	.....	.....
27	Mine 114	Engineering Construction	.....	.....	.....	.....	.....	.....	Preceded by or taken	.....	.....	.....	.....
27	Mine 116	Appraisal	.....	3	6	6	15	2	with Mine 3, 4 or 7, 8	.....	.....	.....	.....
27	Mine 117	Mining Law	.....	2	0	4	6	1	Mine 3 or 7	.....	.....	.....	.....
28	Mine 18	First Aid and Rescue Work	.....	Total of 30 hrs.	.....	.....	.....	.....	Econ. M-5, Mine 3 or 7	.....	.....	.....	.....
28	Mine 119, 120	Adv. Mining	.....	.....	.....	.....	1, 2	.....	Econ. M-3, Mine 1	.....	.....	.....	.....
28	Cok. 1 or 2	Coal Washing	.....	1	6	1	8	1 or 2	.....	.....	.....	.....	.....
28	Cok. 3, 4	Coking	.....	2	6	4	12	1, 2	Chem. 21, 22; Phys. 7, 8	.....	.....	.....	.....
28	Met. 1, 2	Genl. Metallurgy	.....	3	6	6	15	1, 2	Chem. 30, 39	.....	.....	.....	.....
29	Met. 3, 4	Genl. Met. Principles	.....	3	6	4	13	1, 2	With Mine 7, 8	.....	.....	.....	.....
29	Met. 5, 6	Blast Furnace	.....	2	6	4	12	1, 2	Chem. 21, 22; Phys. 7, 8	.....	.....	.....	.....
29	Met. 7, 8	Steel	.....	4	6	6	16	1, 2	With Chem. 41, 42	.....	.....	.....	.....
30	Met. 9, 10	Met. Calculations	.....	3	0	6	9	1, 2	Met. 3, 4	.....	.....	.....	.....
30	Met. 11, 12	Copper, Lead, Minor Metals	.....	2	6	6	15	1, 2	With Met. 3, 4	.....	.....	.....	.....
30	Met. 13, 14	Electro-Metallurgy	.....	2	6	4	12	1, 2	Met. 1, 2	.....	.....	.....	.....
30	Met. 15, 16	Gold and Silver	.....	2	6	4	12	1, 2	Chem. 41, 42; Phys. 7, 8	.....	.....	.....	.....
31	Met. 17 or 18	Fire Assaying	.....	1	6	1	8	1 or 2	Met. 1, 2; Ore 1, 2	.....	.....	.....	.....
31	Met. 119, 120	Metallurgy	.....	2	6	4	12	1, 2	With Met. 1 or 2	.....	.....	.....	.....
			.....	.....	.....	.....	.....	.....	Preceded by or taken	.....	.....	.....	.....
			.....	.....	.....	.....	.....	.....	with Chem. 41, 42	.....	.....	.....	.....

Page	Course No.	Title	Class	Lab.	Hours a Week Study Total	Sem.	Prerequisite	I-a	I-b	Group II	III-a	III-b
31	Met. 121, 122	Adv. Metallurgy				1, 2		Elective				
31	Met. 24	Met. Practice		3 Weeks		2				x		
31	Ore 1, 2	Ore Dressing		3	6	4	Chem. 21, 22; Phys. 7, 8					
32	Ore 3, 4	Adv. Ore Dressing		3	6	13	M. Geol. 5; Gr. 2	x				
32	Oil 101	Geol. of Oil and Gas		4	3	8	Ore, 1, 2	Elective				
32	Oil 102	Comparative Oil Fields		4	6	15	Chem. 1, 2; M. G. 2, 3, 5				x	x
32	Oil 103	Business of O. & G. Prod.		2	0	8	Oil 101				x	x
32	Oil 104	Technology of O. & G. Prod.		2	0	4	*Geol. 101, 102; Oil, 101, 102				x	x
33	Oil 105	Appraisal		2	0	6	*Geol. 101, 102; Oil 101, 102				x	x
33	Oil 106	Exam. and Report		0	9	0	*Oil 105				x	x
33	Oil 107, 108	Adv. Oil and Gas Lab.		{	0	12	*Geol. 101, 102; Oil 101, 102				x	x
33	Oil 9	Chem. and Refining of Pet.		2	6	4	Chem. 39					
33	Oil 10	Surv. Methods in Pet. Geol.		3 Weeks		1	Geol. 101, 102; Oil 101, 102	Elective				
34	Sem. 1, 2	Seminar		1	0	1	M. Geol. 2, 3, 5; Sur. S-3				x	x
34	Sem. 103, 104	Seminar		2	0	2						
34	Sem. 5, 6	Seminar		1	0	1		x	x			
34	Sem. 107, 108	Seminar		2	0	2				x		
34	Sem. 9, 10	Seminar		3	0	3				x		
34	Sem. 111, 112	Seminar		3	0	6				x	x	x
34	Sem. 113, 114	Seminar		2	0	2	With M. G. 115, 116	Elective				
34	Fld. 1	Field Trip		3 Weeks		2		x	x			
35	Fld. 2	Field Trip		3 Weeks		2				x		
35	Fld. 3	Field Trip		3 Weeks		2				x	x	x
35	P. E. 1, 2	Phys. Education		0	4	0		x	x	x	x	x
35	P. E. 3, 4	Phys. Education		0	2	0	P. E. 1, 2	x	x	x	x	x

In addition to the required subjects in a given group, a sufficient number of elective courses shall be scheduled to average 60 hours total a week during eight Semesters.

Subjects required in one group are elective for students in other groups.

Suggested schedule for First Semester, First Year: Psychol. 1, English 3, Math. 21, Chem. 1, Gr. 1, Phys. Ed. 1.

\*Otherwise properly qualified graduate students may take one or more of these courses with Oil 101, 102.

## DEGREES

The degrees conferred upon those satisfactorily completing courses are, respectively:

Engineer of Mines (E. M.), Metallurgical Engineer (Met. E.), Petroleum Engineer (Pet. E.), Bachelor of Science in Petroleum Geology (B. S. in Pet. Geol.).

## COURSES IN THE SCHOOL OF MINES

### UNDERGRADUATE

In order to retain the advantages of the elective system whereby the student is permitted to choose his work along the line for which he seems best fitted, and at the same time to be certain that every man shall have a well-rounded course, the following group system is in effect:

Certain courses are required of all students. In each option, i. e., General Mining and Metallurgy, Coal Mining and Coking, the Metallurgy of Iron and Steel, and Oil and Gas Production, a further group of courses is required, leaving a margin for electives either in the major subject or in other subjects taught in the School (in special cases subjects taught in other Schools of the University may be elected).

### INSPECTION

The industries in Pittsburgh and those conveniently accessible to the city are especially well adapted to illustration of the subjects taught in the School of Mines. Accordingly, visits of inspection to mines, mills, furnaces, oil wells, etc., are scheduled at frequent intervals. Owners and managers cooperate in every way possible, and the trips add greatly to the efficiency of the instruction. Each trip is under the direct supervision of an instructor, and written reports are required.

A field trip of three weeks, under the supervision of instructors, is required.

### COOPERATIVE WORK

During the summer vacations, except the one in which Surveying is scheduled, the student is required to spend his time in practical work in mine, mill or smelter, or in the field; he is here placed upon the same basis as other employes of the company to which he is assigned, and receives the same pay as others doing the same grade of work. The superintendent advises the Dean periodically as to the progress made, and at the close of the summer period the student makes a written report, which is graded in the same way as is class work. Upon graduation, then, he will have had the advantage of considerable practical work in his chosen field. An important feature of the work of the School of Mines is this linking of theory with practice and it is of great value to the student in his preparation for his profession.

The positions to which students are assigned cover all phases of the work in mining, metallurgy, geology and oil and gas production. In addition to the Pittsburgh district, students are placed in Arizona, Colorado, Idaho, Michigan, Minnesota, Montana, Missouri, New Mexico, Oklahoma, South Dakota, Texas, Canada, etc.

#### FINAL EXAMINATION FOR GRADUATION

At the end of the last year a comprehensive examination is conducted, which may include any of the work covered in the course, and which will be preceded by a review of the major subjects. The object of this examination is to insure that the student's work is properly correlated in his own mind, and that he is able to apply the principles of such subjects as mathematics and the sciences to mining, metallurgy, ore dressing or oil and gas production.

#### GRADUATE

For graduate courses in the School of Mines, see also the bulletin of the Graduate School.

The aim is to offer such advanced work in Economic Geology, Mining, Oil and Gas, Metallurgy and Ore Dressing, as will meet the needs of men having at least one year of practical work following graduation from a recognized mining school.

In addition to the subjects mentioned above, certain courses in Economics, Sociology and Psychology, etc., have been arranged with special reference to their application to mining and metallurgy, with the idea of training men along managerial lines.

Each application will be decided upon its own merits. In general, however, graduation from a recognized technical school, supplemented by at least one year's practical work, will be necessary for admission.

#### DEPARTMENTS OF INSTRUCTION

The following includes the required courses in the School of Mines, together with a few electives which it was thought might be chosen by students of the school. For further studies which are open as electives, see the general catalog of the University.

The number of hours a week required for a given course is divided between class, laboratory and study. Class hours cover lectures, recitations, quizzes and conferences. Laboratory hours are those required to be spent in practical work in the laboratory assigned. The sum of these two represents the total number of hours required to be spent in school. The number of hours listed for study is intended to include the amount of time deemed necessary for thorough preparation, and may include study, reference reading, writing of reports, writing up lecture or laboratory notes, etc. The total number of hours given for a course will therefore cover the entire amount of time in school and outside which the average student is expected to devote to that particular subject.

Lecture rooms and laboratories, when unoccupied by classes, are available for use as study rooms. The schedule of such rooms, with available hours, will be posted at the beginning of each semester. If the student takes advantage of this opportunity, the time necessary for night work is reduced to a minimum.

## PSYCHOLOGY

DR. SNYDER

### I. HOW TO STUDY.

First Semester

This course is arranged to make clear the essential principles of effective study. Special emphasis is paid to such topics as bodily conditions for effective study, how to use reference books, how to take notes, the cultivation of correct habits of study—the purpose being to make all kinds of study easier, more pleasant, and more productive.

Hours a week: Class 1, Study 1, Total 2.

Required in all groups.

## ENGLISH

MR. —————

3, 4.

First and Second Semesters

A course designed particularly for prospective mining engineers, comprising detailed study of the formal mechanics of writing; the rules of sentence, paragraph, and thematic structure, especially as applied to technical exposition and argumentation; oral reports and public speaking; the engineering profession—its dignity, its scope and the requisites for its successful practice.

Hours a week: First Semester, Class 4, Study 8, Total 12.

Second Semester, Class 1, Study 2, Total 3.

Required in all groups.

## MODERN LANGUAGES

### GER. 1, 2. ELEMENTARY GERMAN.

First and Second Semesters

Hours a week: Class 3, Study 6, Total 9.

Elective.

### GER. 3, 4. INTERMEDIATE GERMAN.

First and Second Semesters

Hours a week: Class 3, Study 6, Total 9.

Prerequisite: Ger. 1, 2, or two years of High School German.

GER. T 3, T 4. TECHNICAL GERMAN.

First and Second Semesters

Hours a week: Class 3, Study 6, Total 9.

Prerequisite: Ger. 1, 2, or two years of High School German.

FR. 1, 2. ELEMENTARY FRENCH.

First and Second Semesters

Hours a week: Class 3, Study 6, Total 9.

Elective.

FR. 3, 4. INTERMEDIATE FRENCH.

First and Second Semesters

Hours a week: Class 3, Study 6, Total 9.

Prerequisite: Fr. 1, 2.

SP. M 1. ELEMENTARY SPANISH.

First Semester

Hours a week: Class 5, Study 10, Total 15.

Elective.

SP. M 2. SPANISH CONVERSATION.

Second Semester

Hours a week: Class 2, Study 4, Total 6.

Prerequisite: Sp. M 1.

## MATHEMATICS AND MECHANICS

MR. CLELAND AND MESSRS. ——— AND ———

21, 22.

First and Second Semesters

A combined course in mathematics treating: graphic algebra, trigonometry with applications to surveying and mechanics; analytic geometry; higher algebra; differential calculus.

Hours a week: Class 6, Study 12, Total 18.

Required in all groups.

23, 24.

First and Second Semesters

A continuation of Math. 21, 22, including: integral calculus; analytic mechanics (the principles of mechanics, founded on Newton's Laws of Motion; applications to the simpler physical problems of particles and bodies in equilibrium and in motion); mechanics of materials; hydraulics.

Hours a week: Class 6, Study 12, Total 18.

To be preceded by Math. 21, 22 and taken with Phys. 7, 8.

Required in Groups I, II and III-a.

## CHEMISTRY

PROFESSOR SILVERMAN AND ASSISTANTS

### 1, 2. GENERAL INORGANIC CHEMISTRY.

Professor Silverman and Assistants.

First and Second Semesters

A study of the metals and non-metals, principles, theories, and calculations. Visits are made to a considerable number of manufacturing establishments so that the student may see practical applications of chemical principles.

Hours a week: Class 4, Laboratory 6, Study 4, Total 14.

Required in all groups.

### 21. QUALITATIVE ANALYSIS.

Assistant Professor Witt, Mr. Wescott.

First Semester

The reactions employed in qualitative analysis for the detection and separation of the common metals and acids are studied from the standpoint of electrolytic dissociation and chemical equilibria.

Hours a week: Class 2, Laboratory 6, Study 4, Total 12.

Prerequisite: Chem. 1, 2.

Required in all groups.

### 22. QUANTITATIVE ANALYSIS.

Assistant Professor Witt, Mr. Wescott.

Second Semester

The aim in this short course is to acquaint the student with the principal methods of gravimetric and volumetric analysis by means of a carefully selected series of laboratory exercises.

Hours a week: Class 2, Laboratory 6, Study 4, Total 12.

Prerequisite: Chem. 21.

Required in all groups.

### 30. FUEL ANALYSIS.

Assistant Professor Witt, Mr. Wescott.

Second Semester

This course includes the analysis of natural gas, artificial gas, flue gases and gas calorimetry; the analysis and calorimetry of coal and the analysis and physical testing of oils.

Hours a week: Class 1, Laboratory 6, Study 2, Total 9.

Prerequisite: Chem. 21, 22.

Required in Groups I-b and III.

### 39. NATURAL DEBRIS AND HYDROCARBONS.

Assistant Professor Lowy, Mr. Downey.

First Semester

Special emphasis is laid on occurrence, preparation, properties and uses of carbon and hydrocarbons.

Hours a week: Class 4, Laboratory 6, Study 4, Total 14.

Prerequisite: Chem. 1, 2.

Required in Groups I-b and III.

**41, 42. PHYSICAL CHEMISTRY.**  
Assistant Professor Stegeman.

First and Second Semesters

A study of the laws governing chemical phenomena. The second semester is devoted to a consideration of the theoretical principles and some practical applications of electrochemistry.

Hours a week: Class 2, Laboratory 3, Study 4, Total 9.

Prerequisite: Math. 21, 22; Chem. 21, 22; Phys. 7, 8.

Required in Groups II and III.

**PHYSICS**

PROFESSOR WENRICH AND ASSISTANTS

**7, 8. GENERAL PHYSICS.**

First and Second Semesters

First semester, mechanics, heat and part of electricity. Second semester, electricity, sound and light. Special attention is given to the practical applications in mining engineering.

Lectures on the precision of measurements will precede the laboratory work. Stress is laid on the precision of results obtained in the experiments.

Hours a week: Class 4, Laboratory 3, Study 6, Total 13.

Prerequisite: Math. 21, 22.

Required in all groups.

**ECONOMICS**

DEAN MELLER, PROFESSORS WRIGHT and ARNOLD, MR. MCCRADY

**M 2. PRINCIPLES OF ECONOMICS.**

Second Semester

Fundamental concepts of economics; theory of value, production; present day problems of economics and an application of economic theory to the settlement of these problems; wages, labor unions, trusts and monopolies, interest, taxation, immigration, socialism, etc.

Hours a week: Class 5, Study 6, Total 11.

Required in all groups.

**M 3. BUSINESS LAW.**

Mr. McCrady.

First Semester

Elementary principles of law as applied to common business transactions. Contracts; damages; principal and agent; negotiable instruments, etc.

Hours a week: Class 2, Study 4, Total 6.

Prerequisite: Econ. M 2.

Required in all groups.

**M 4. CONTRACTS AND SPECIFICATIONS.**

Second Semester

Hours a week: Class 2, Study 4, Total 6.

Prerequisite: Econ. M 3.

Required in all groups.

## M 5, 6. ECONOMICS OF MINERAL TECHNOLOGY.

First and Second Semesters

Mining and allied industries; industrial management; labor problems; corporation finance; accounting; statistics.

Hours a week:

First Semester: Class 5, Study 6, Total 11.

Second Semester: Class 2, Study 4, Total 6.

Elective.

## M 8. Technical Writing.

Professor Arnold.

Second Semester

Study and practice in preparing reports and special magazine articles. The style of the best technical magazines is analyzed and used as models.

Hours a week: Class 2, Study 4, Total 6.

Elective.

## GEOLOGY

PROFESSORS JOHNSON AND SOMERS

### 101, 102. GEOLOGICAL METHODS.

First and Second Semesters

A training course for men who intend to do field work in geology. General scientific method. Specific geological methods. History of geology from standpoint of method. Study of carboniferous and cretaceous geology from standpoint of method.

Hours a week: Class 2, Laboratory 3, Study 4, Total 9.

Prerequisite: M. Geol. 2, 3, 5.

Required in Group III.

### 103, 104. GEOLOGICAL LABORATORY.

First and Second Semesters

Work upon a series of problems adapted to the needs of the particular student, or research in one problem.

Hours a week: 6.

Prerequisite: Geol. 101, 102.

Elective.

## PALEONTOLOGY

PROFESSOR ORTMANN

### 1, 2. GENERAL PALEONTOLOGY.

First and Second Semesters

This course is intended to present a general survey of the field of Invertebrate Paleontology, the rich resources of the Carnegie Museum providing splendid facilities for study.

Hours a week: 3.

Prerequisite: M. Geol. 3.

Required in Group III.

## MINING GEOLOGY

PROFESSOR LEIGHTON AND MR. ———

### 2. GENERAL GEOLOGY.

Second Semester

The introductory course in geology, covering dynamic and structural geology. Laboratory work consists of study of topographic and geologic maps, common minerals and rocks, and a few local field trips.

Hours a week: Class 3, Laboratory 3, Study 6, Total 12.

Prerequisite: Chem. 1.

Required in all groups.

### 3. HISTORICAL GEOLOGY.

First Semester

A study of the earth's origin and of the life and physiographic conditions prevailing in the various periods of geologic history.

Hours a week: Class 3, Study 6, Total 9.

Prerequisite: M. Geol. 2.

Required in Groups I and III.

### 5. INTRODUCTORY MINERALOGY.

First Semester

After a brief summary of the subject of crystallography and determinative mineralogy, one hundred of the more common minerals are described and studied. This is followed by a study of the common rocks.

Hours a week: Class 2, Laboratory 6, Total 8.

Prerequisite: M. Geol. 2.

Required in all groups.

### 6. MINERALOGY.

Second Semester

A more detailed course planned to follow M. Geol. 5 and to enter more thoroughly into the subject of crystallography and determinative methods, with a study of an additional 150 minerals of importance to the mining engineer.

Hours a week: Class 2, Laboratory 6, Total 8.

Prerequisite: M. Geol. 5.

Required in Group I-a.

### 8. ECONOMIC GEOLOGY.

Second Semester

A short course designed for those wishing a rapid survey of the mode of occurrence, distribution and uses of the more important mineral resources, both non-metallic and metallic.

Hours a week: Class 3, Study 6, Total 9.

Prerequisite: M. Geol. 2, 3, 5.

Required in Groups I and III.

## 9. ORE DEPOSITS.

First Semester

A study of the theories of ore deposition and their application to the ore deposits of the important districts of the United States and to some of the foreign localities.

Hours a week: Class 3, Study 6, Total 9.

Prerequisite: M. Geol. 8.

Required in Group I-a.

## 10. THE GEOLOGY OF COAL.

Second Semester

A study of the coal fields of the United States from a geologic standpoint, with brief reference to the important foreign fields.

Hours a week: Class 2, Study 4, Total 6.

Prerequisite: M. Geol. 8.

Required in Group I-b.

## 11, 12. PETROGRAPHY.

First and Second Semesters

A study of optical crystallography, the determination of minerals by optical methods, and the determination and classification of rocks by means of the petrographic microscope.

Hours a week: Class 1, Laboratory 6, Study 2, Total 9.

Prerequisite: M. Geol. 6.

Elective.

## 113, 114. ADVANCED MINERALOGY.

First and Second Semesters

Advanced work in crystallography, mineralogy or petrography can be provided for graduate students or qualified undergraduates. Subject matter and time will be arranged to meet the demand.

Prerequisite: M. Geol. 6.

Elective.

## 115, 116. ADVANCED ECONOMIC GEOLOGY.

First and Second Semesters

Special investigation will be arranged and supervised, dealing with any of the varied mineral deposits. Course and time will be arranged to meet the demand. Primarily for graduate students but open to properly qualified undergraduates.

Prerequisite: M. Geol. 9.

Elective.

## 117, 118. FOREIGN MINERAL DEPOSITS.

First and Second Semesters

A review of the geology and the mineral resources of foreign countries.

Prerequisite: M. Geol. 9.

Elective.

## GRAPHICS

PROFESSOR BLACK AND MR. ———

### 1, 2. ENGINEERING DRAWING.

First and Second Semesters

Use of instruments; freehand and mechanical lettering; freehand sketching; graphic solution of geometric problems, fundamental problems dealing with points, lines, planes and solids; orthographic, isometric and perspective projections; drawing of bolts, screws and rivets; working drawings, assembly and detail; elements of structural drawing; shading; tracing; blue printing.

Hours a week: Class 1, Laboratory 6, Study 1, Total 8.

To be taken with Math. 21, 22.

Required in all groups.

### 3. GRAPHIC STATICS.

First Semester

Graphic solutions for stresses in the members of roof trusses, bridge trusses and other statically determinate framed structures. Methods for dead, snow, wind and moving loads and moment of inertia, also for bending moment, shear and deflection in beams under concentrated and uniform loads.

Hours a week: Class 1, Laboratory 6, Study 1, Total 8.

Prerequisite: Gr. 1, 2; Math. 23, 24; Phys. 7, 8.

Required in Groups I and II.

## SURVEYING

PROFESSOR BLACK, MR. CARL AND MR. STAUFF

### 2. ELEMENTARY MAPPING.

Second Semester

Plotting with protractor by angles or bearings; plotting by latitudes and departures; computation of traverses and areas from field notes; balancing of surveys by computation or graphical method; topographic symbols and conventions; contours; freehand and mechanical lettering; titles. Frequent application is made of the principle of algebra, trigonometry and logarithms. This course is intended to facilitate the mapping required in the courses following.

Hours a week: Class 1, Laboratory 3, Total 4.

Prerequisite: Math. 21, Gr. 1.

Required in all groups.

### S 3. GENERAL SURVEYING.

Standardizing of pace; practice in pacing; adjustment of hand level; determination of elevations with hand level; staking of mining claim and filing notice of location; topographic survey of mining claim by pacing and hand level.

Adjustment of compass; compass traverse; adjustment of transit; repetition traverse; azimuth traverse; farm survey with transit, computation of farm acreage; United States public land survey; layout of city streets, blocks, and lots; adjustment of plane table and alidade; topographic survey with plane table; adjustment of stadia; topographic survey with transit and stadia; official survey of mining claim; adjustment of engineer's level; leveling between bench marks.

Standardizing of steel tape; measurement of base line; triangulation, including practice in reading angles, computation and adjustment of system; solar observations for azimuth, latitude and time; observation on Polaris for azimuth, latitude and time.

Maps are required of the mining claim pacing survey, mining claim official survey, the compass, azimuth and repetition traverses, farm survey, city survey and stadia survey.

The class is divided into squads, usually of four men each, each man being required to do every kind of work with every instrument used, make a full set of notes of the work done by his squad, and from these notes make these maps in the drafting room.

50 hours a week, 8 weeks, summer term.

Prerequisite: Sur. 2, Math. 21.

Required in Groups I and III.

#### S 4. RAILROAD SURVEYING.

Reconnaissance with aneroid and pocket compass; preliminary survey with transit, chain and engineer's level; topography with hand level; paper location; computation of simple and compound curves; final location of tangents and curves with transit and steel tape; leveling for profile; cross sectioning; computation of cuts and fills; computing and staking of turn-outs, frogs and switches.

Each student is assigned his quota of every kind of field work, is required to make a complete set of notes of the surveys and to prepare his individual maps, etc. The maps required are those of the reconnaissance, preliminary survey with paper location and the final location. The profiles and cross-sections also are plotted.

50 hours a week, Summer Term, following Sur. S 3.

Required in Groups I and III.

#### 6. UNDERGROUND SURVEYING.

Second Semester

Underground practice in traversing; survey of secondary openings; surveying for details; shaft plumbing by various methods; use of auxiliary telescope and other instruments for steep sighting.

50 hours a week, 3 weeks at close of second semester.

Prerequisite: Sur. S 3, S4.

Required in Group I.

## 7, 8. MINE MAPPING.

First and Second Semesters

Recording, tabulating and computing survey notes; making of maps from survey notes; plan and sections of ore mine; plans of anthracite and bituminous coal mines, latter from notes taken in Sur. 6; special problems of underground surveying with illustrations from surveys previously mapped; use of planimeter and pantograph.

Hours a week: Laboratory 6.

Prerequisite: Sur. 6.

7 required in Group I.

8 elective.

## MINING

DEAN MELLER, PROFESSOR BLACK AND MR. ———

The aim of the curriculum in Mining Engineering is to provide the fundamentals upon which the graduate may build a successful experience, leading ultimately to the ability to initiate, direct and carry through a mining enterprise. In order to conduct mining operations intelligently, he will be called upon as an engineer to employ the principles of mathematics and physics; the sciences of geology, mineralogy, chemistry and metallurgy; and the arts of civil, mechanical and electrical engineering. He must also have ability for organization and business management.

Class instruction is supplemented at appropriate times by visits to mines in the vicinity; by reference to mine maps, models, drawings, photographs, lantern slides, motion pictures and other illustrative material. Standard books and periodicals, 'manufacturers' catalogues and bulletins serve to keep the instruction abreast of current progress.

### I. PRINCIPLES OF MINING.

Professor Black.

First Semester

A brief course, covering the subject fully in outline, but enlarged upon later for those specializing in mining. Includes: History of mining, prospecting, boring, placer mining, rock drills, explosives, surface mining, methods of entry, shaft sinking and tunneling, support of excavations, methods of mining, mining machinery, gases, lighting, ventilation, haulage, hoisting, drainage, surface plant, accidents, "Safety First", labor, welfare, sanitation, organization of working force.

Visits of inspection are made to working mines in order that the students may become acquainted with the practical application of the principles discussed in the classroom. A written report on each visit is required, accompanied by sketches.

Hours a week: Class 5, Study 6, Total 11.

Required in all groups.

## 2, 3, 4. PRACTICE OF MINING-ORE.

Dean Meller and Professor Black.

Three Semesters

These courses amplify the subjects treated in Mine 1, where that treatment is not sufficiently comprehensive for the engineer interested primarily in mining operations. Both the technical and commercial aspects of mining are treated. Methods of mining iron, copper, gold, silver, lead, zinc and other ores are studied in detail. Numerous mathematical and other problems, similar to those met in actual engineering practice are introduced in order to apply the principles covered, and a considerable amount of original and individual work is expected. As far as possible, the problems form a series, based on data relating to a hypothetical mine and plant. There are numerous applications of subjects previously covered, such as the courses in graphics, mathematics, mechanics, physics, chemistry and geology. Special emphasis is laid on the most recent practice. Working mines in Pennsylvania and adjacent states are used for purposes of illustration.

Subjects covered here, but not included in Mine 1 are as follows:

Power Plant—Steam, compressed air and electric; practical tests on each in laboratory and at mines.

Mine Machinery—Steam, compressed air, electric and gasoline; study of consumption, efficiency and cost of operation. Equipment for haulage, hoisting, drainage, ventilation and rock drilling is considered.

Plant Design—Preparation of working drawings for the ordinary timber and steel surface structures, such as head frame, ore bin, boiler house, etc.; preparation of bills of material and cost estimates.

Law—Revised Statutes and subsequent Acts of Congress, together with Land Office procedure, affecting title to mineral land and other mining rights in the United States; laws of various states relating to underground operations.

Hours a week:

Mine 2—Class 4, Laboratory 6, Study 4, Total 14.

Mine 3, 4—Class 4, Laboratory 9, Study 4, Total 17.

Prerequisite: Math. 23, 24; Chem. 1, 2; Phys. 7, 8; Mine 1.

Required in Group I-a.

## 6, 7, 8. PRACTICE OF MINING—COAL.

Professor Black.

Three Semesters

These courses are similar in plan and scope to those described under Practice of Mining-Ore, but devote the time spent on methods of mining chiefly to coal, rather than the ores. Direct application of all the subjects enumerated is made to coal mining. Gases, Ventilation, Lighting, Coal Mining Machinery and the law of coal mining states are treated in detail, thus meeting the special needs of students having a definite preference for coal mining.

Hours a week:

Mine 6—Class 4, Laboratory 6, Study 4, Total 14.

Mine 7, 8—Class 4, Laboratory 9, Study 4, Total 17.

Prerequisite: Math. 23, 24; Chem. 1, 2; Phys. 7, 8; Mine 1.

Required in Group I-b.

#### 109, 110. POWER PLANT AND MACHINERY.

Professor Black.

First and Second Semesters

A detailed and critical study of power generation, transmission and use in machines adapted to mine requirements. Steam, compressed air, electricity and gasoline are treated. Tests are made on equipment under working conditions at the mines.

Hours a week: Class 3, Laboratory 6, Study 4, Total 13.

To be preceded by or taken with Mine 3, 4 or 7, 8.

Elective.

#### 114. ENGINEERING CONSTRUCTION.

Professor Black and Mr. ———.

Second Semester

A continuation of the subject of Plant Design treated in other courses, but including a greater variety of problems and involving additional principles. Trestles, dams, foundations and structures of masonry and reinforced concrete are designed, as well as mine cars, cages and skips. Statically indeterminate structures are treated.

To be preceded by or taken with Mine 4 or 8.

Elective.

#### 116 APPRAISAL.

Dean Meller.

Second Semester

A study of the factors determining the value of a producing mine or a prospect.

Hours a week: Class 3, Laboratory and Library 6, Study 6, Total 15.

To be preceded by Econ. M 5; preceded by or taken with Mine 4 or 8.

Elective.

#### 117. MINING LAW.

Professor Black

First Semester

Analysis of state mining laws; study of court decisions in the United States affecting mining; study of laws relating to mineral land title and mining practice in Canada, Mexico and other countries.

Hours a week: Class 2, Study 4, Total 6.

Prerequisite: Econ. M 3; Mine 1.

Elective.

## 18. FIRST AID AND MINE RESCUE WORK.

Second Semester

This course includes instruction in the following subjects: Bruises, sprains, fractures, shock, burns, gas poisoning, etc; principles, design and use of the helmet and mouth-breathing devices, resuscitation apparatus, and in the methods of mine rescue work.

Total number of hours, 30.

Required in all groups.

## 119, 120. ADVANCED MINING.

First or Second semesters

Intended to afford advanced and graduate students an opportunity to continue the study of mining for a post-graduate degree.

Arranged to suit the needs of the individual student.

Elective.

## COAL WASHING AND COKING

PROFESSORS RAY AND BLACK

### 1 or 2. COAL WASHING.

Professor Ray.

First or Second Semester

Designed to teach the principles and practice of coal washing. A study will be made of ore dressing machinery and principles as applied to the washing of coal.

Hours a week: Class 1, Laboratory 6, Study 1, Total 8.

Prerequisite: Chem. 21, 22; Phys. 7, 8; M. Geol. 5; Gr. 2.

Required in Group 1-b.

### 103, 104. COKING.

Professor Black.

First and Second Semesters

Coals adapted to coking; varieties of coke; coal preparation; oven construction, design and operation; by-products, recovery and uses; coke oven machinery; laboratory tests on coking processes; costs and markets; visits of inspection to operating plants.

Hours a week: Class 2, Laboratory 6, Study 4, Total 12.

To be preceded by Chem. 30 and 39; preceded by or taken with Mine 7, 8.

Required in Group 1-b.

## METALLURGY

PROFESSORS GOODALE AND RAY AND MR. ———

### 1, 2. GENERAL METALLURGY.

Professor Ray and Mr. ———

First and Second Semesters

This course will serve as a basis of metallurgical knowledge for those specializing in mining, or as a beginning course for those desiring to

follow non-ferrous metallurgy. It covers the methods of winning the common metals from the minerals in which they occur in nature, the properties and uses of metals and alloys, and the study of refractories, fuels and other materials, as well as the apparatus used in metallurgical operations. The metals chiefly studied are iron and steel, copper, lead, gold and silver; and less completely zinc, tin, nickel, etc.

Hours a week: Class 3, Laboratory 6, Study 6, Total 15.

Prerequisite: Chem. 21, 22; Phys. 7, 8; M. Geol. 5; Gr. 2.

Required in Group I-a.

### 3, 4. GENERAL METALLURGICAL PRINCIPLES.

Professors Goodale and Ray.

First and Second Semesters

The introductory course for those students specializing in metallurgy. Includes a study of the materials used in metallurgical works, such as fuels and refractory materials, and also the metals, alloys and other products of those works, and the operations by which they are produced. The laboratory work follows closely the class work and is concerned largely with the measurements by which the above processes are controlled, and with a study of the materials themselves in the laboratory.

Hours a week: Class 3, Laboratory 6, Study 4, Total 13.

To be preceded by Chem. 21, 22; Phys. 7, 8; and preceded by or taken with Chem. 41, 42.

Required in Group II.

### 5, 6. THE IRON BLAST FURNACE.

Professor Goodale.

First and Second Semesters

A study of the design, construction and operation of the blast furnace and its accessories. In connection with the following courses it is planned to cover as completely as possible the special metallurgy of iron and steel so important to Pittsburgh.

Hours a week: Class 2, Laboratory 6, Study 4, Total 12.

To be taken with Met. 3, 4.

Required in Group II.

### 7, 8. THE MANUFACTURE AND PROPERTIES OF STEEL.

Professor Goodale.

First and Second Semesters

The design, construction and operation of the various furnaces and machinery used in the refining of pig iron and manufacture of steel, wrought iron, etc. A number of visits to neighboring plants may be made in connection with the laboratory work of the course. The laboratory work includes a study of the metals with the microscope and experiments in reduction and refining.

Hours a week: Class 4, Laboratory 6, Study 6, Total 16.

Prerequisite: Met. 3, 4.

Required in Group II.

## 9, 10. METALLURGICAL CALCULATIONS.

Professor Goodale.

First and Second Semesters

A study of and practice in the calculations relating to the design of metallurgical apparatus, the quantities of heat and material required in operations, and the costs involved.

Hours a week: Class 3, Study 6, Total 9.

To be taken with Met. 3, 4.

Required in Group II.

## 11, 12. COPPER, LEAD, MINOR METALS.

Professors Goodale and Ray.

First and Second Semesters

An advanced course supplementing Met. 1, 2, taking up a more detailed study of the furnaces and other apparatus used, the operations involved and methods of control. Designed for those men of Group I-a who desire a more thorough training in non-ferrous metallurgy.

Hours a week: Class 3, Laboratory 6, Study 6, Total 15.

Prerequisite: Met. 1, 2.

Elective.

## 113, 114. ELECTRO-METALLURGY.

Professor Goodale and Mr. ———

First and Second Semesters

A careful study of electro-thermic and electrolytic methods applied to the recovery of metals from their ores, and the refining of metals. These methods are of rapidly growing application and importance. The electric furnace is being used for many operations where previously fuel-heated furnaces were used, and electrolytic methods are supplanting older methods for refining and even winning metals. This course is designed to cover such operations.

Hours a week: Class 2, Laboratory 6, Study 4, Total 12.

Prerequisite: Chem. 41, 42; Phys. 7, 8.

Elective.

## 15 or 16. GOLD AND SILVER.

Professor Ray.

First or Second Semester

A course covering the metallurgy of gold and silver with special reference to the hydrometallurgy or leaching processes, such as cyanidation, chlorination, etc. The cyanide process is treated in detail on account of its present importance. The refining of bullion by different methods is thoroughly treated. This course will in general be taken by the same men as take Met. 11, 12 and must be taken by those men taking Ore 3, 4.

Hours a week: Class 2, Laboratory 6, Study 4, Total 12.

Prerequisite: Met. 1, 2; Ore 1, 2.

Elective.

17 or 18. FIRE ASSAYING.

Professor Ray and Mr. ———

First or Second Semester

Designed for all students taking either Met. 1, 2 or Ore 1, 2, and must be taken coincident with either one of these or before. The course is designed to give the student a thorough theoretical and practical knowledge of the assaying of ores and metallurgical products containing gold, silver and the platinum metals by fire methods.

Hours a week: Class 1, Laboratory 6, Study 1, Total 8.

To be taken with Met. 1 or 2.

Required in Group I-a.

119, 120. Metallography.

Professor Goodale and Mr. ———

First and Second Semesters

The study of metals and alloys, their structure, properties. The work of this course includes microscopic methods of study, and also chemical and physical testing and investigation of the properties of metals. Much of the work of this course is given in the laboratory work of Met. 7, 8.

Hours a week: Class 2, Laboratory 6, Study 4, Total 12.

To be preceded by or taken with Chem. 41, 42.

Required in Group II.

121, 122. ADVANCED METALLURGY.

Professors Goodale and Ray.

First and Second Semesters

It is designed to give advanced students an opportunity to pursue the study of metallurgy for a postgraduate degree. The work is carried on in each case as the occasion seems to require, to give each student the greatest advantage from the work.

Elective.

24. METALLURGICAL PRACTICE.

Professor Goodale and Mr. ———

Second Semester

Laboratory work 50 hours a week for three weeks at end of second year.

Required in Group II.

ORE DRESSING

PROFESSOR RAY

1, 2. GENERAL ORE DRESSING.

First and Second Semesters

A general course dealing with the principles and practice of dressing of ores and minerals, designed for students of Group I-a. It includes the object and principles of ore dressing; stamp milling, followed by amalga-

mation and concentration; description of the construction and operation of the principal types of crushers, stamps, classifiers, etc.

Hours a week: Class 3, Laboratory 6, Study 4, Total 13.

Prerequisite: Chem. 21, 22; Phys. 7, 8; M. Geol. 5, Gr. 2.

Required in Group I-a.

### 3, 4. ADVANCED ORE DRESSING.

First and Second Semesters

A course designed for those students desiring to have a more complete knowledge of this subject. A more detailed study of principles involved, a closer study of apparatus and their applications, concentration calculations, and commercial factors involved will make up this course. An especial study of flotation will be made. Considerable latitude will be allowed in laboratory work, in order to give the student particular study of some phase in which he may be interested.

Hours a week: Class 3, Laboratory 6, Study 6, Total 15.

Prerequisite: Ore 1, 2.

Elective.

## OIL

PROFESSORS JOHNSON AND SOMERS

### 101. GEOLOGY OF OIL AND GAS.

First Semester

Origin, accumulation and occurrence of oil, gas and oil shales. Methods of determining chances of success in locating oil and gas wells.

Hours a week: Class 4, Laboratory 3, Study 8, Total 15.

Prerequisite: Chem. 1, 2; M. Geol. 2, 3, 5.

Required in Group III.

### 102. COMPARATIVE OIL FIELDS.

Second Semester

A comparative study of the oil and gas fields and promising untested regions of the world.

Hours a week: Class 4, Laboratory 6, Study 8, Total 18.

Prerequisite: Oil 101.

Required in Group III.

### 103. BUSINESS OF OIL AND GAS PRODUCTION.

First Semester

Leasing, organization of companies, methods of cooperation in drilling tests and offsetting, operation on public lands, drilling contracts, natural gas industry, etc. History, leading Companies.

Hours a week: Class 2, Study 4, Total 6.

\*Prerequisite: Geol. 101, 102; Oil 101, 102.

Required in Group III.

### 104. THE TECHNOLOGY OF OIL AND GAS PRODUCTION.

Second Semester

Spacing of wells, drilling, pumping, transportation and storage. Increasing the percentage of recovery. Gasoline from gas. Distribution of gas.

Hours a week: Class 2, Study 4, Total 6.

\*Prerequisite: Geol. 101, 102; Oil 101, 102.

Required in Group III.

105. APPRAISAL.

First Semester

Methods by which the value of oil and gas properties is determined. The methods of examination and of making reports upon properties.

Hours a week: Class 2, Study 6, Total 8.

\*Prerequisite: Geol. 101, 102; Oil 101, 102.

Required in Group III.

106. EXAMINATION AND REPORTS.

Second Semester

The actual examination and preparation of a report of an oil or gas property.

9 hours a week.

\*Prerequisite: Oil 105.

Required in Group III.

107. OIL AND GAS LABORATORY.

First Semester

Exercises and investigations with oil field maps, geological maps, statistics, records of companies, cuttings from wells, etc., in the geology, business and technology of oil and gas. The work is partly individual and partly original.

12 hours a week.

\*Prerequisite: Geol. 101, 102; Oil 101, 102.

Required in Group III.

108. ADVANCED OIL AND GAS LABORATORY.

Second Semester

A continuation of Oil 7.

9 hours a week.

\*Prerequisite: Geol. 101, 102; Oil 101, 102.

Required in Group III.

9. CHEMISTRY AND REFINING OF PETROLEUM.

First Semester

A course on the chemistry, distillation and refining of petroleum.

Hours a week: Class 2, Laboratory 6, Study 4, Total 12.

Prerequisite: Chem. 39; Geol. 101, 102; Oil 101, 102.

10. SURVEYING METHODS IN PETROLEUM GEOLOGY.

Second Semester

Training in the use of instruments, especially plane table and stadia, to fit men for summer work as assistants in the field.

50 hours a week, 3 weeks at close of second semester.

Required in Group III.

Prerequisite: M. Geol. 2, 3, 5; Sur. S 3.

\*Otherwise properly qualified graduate students may take one or more of these courses with Oil 101, 102.

## SEMINAR

1, 2.

Dean Meller, Prof. Black and Prof. Ray.

First and Second Semesters

Hours a week: Class 1, Study 1, Total 2.

Required in Group I.

103, 104.

Dean Meller, Prof. Black and Prof. Ray.

First and Second Semesters

Hours a week: Class 2, Study 2, Total 4.

Required in Group I.

5, 6.

Professor Goodale.

First and Second Semesters

Hours a week: Class 1, Study 1, Total 2.

Required in Group II.

107, 108.

Professor Goodale.

First and Second Semesters

Hours a week: Class 2, Study 2, Total 4.

Required in Group II.

9, 10.

Professors Johnson and Somers.

First and Second Semesters

Hours a week: Class 3, Study 3, Total 6.

Required in Group III.

111, 112.

Professors Johnson and Somers.

First and Second Semesters

Hours a week: Class 3, Study 3, Total 6.

Required in Group III.

113, 114.

Professor Leighton.

First and Second Semesters

To be taken with M. Geol. 115, 116.

Elective.

## FIELD TRIPS

Field trips are required at the end of the third year of the normal four year course. Class work ends sufficiently early to allow the field trips to be completed by the end of Commencement Week so that no time

is lost from required cooperative work. Each party is in charge of one or more members of the faculty. There is no fee, but the student pays his own traveling expenses.

1. GEOLOGICAL AND MINING TRIP.

Required in Group I.

2. METALLURGICAL TRIP.

Required in Group II.

3. OIL AND GAS TRIP.

Required in Group III.

## PHYSICAL EDUCATION

Physical Training is prescribed for all First and Second Year students.

Men students are required to be able to swim a distance of twenty yards by the end of the Second Year.

No student is permitted to participate in competitive games unless he is physically fit, as determined by the physical examination made by the University Department of Health.

Hours a week in Gymnasium:

1, 2—First Year—4.

3, 4—Second Year—2.

## MILITARY SCIENCE AND TACTICS

An Infantry Unit of the Senior Division of the Reserve Officers' Training Corps was established at the University of Pittsburgh by Bulletin No. 10, paragraph 11, War Department, March 1, 1918. Three hours a week is allotted to military training and instruction during the first two years; five hours a week during the remainder of the course.

Elective for students in the School of Mines who are citizens of the United States, and whose bodily condition indicates that they are physically fit to perform military duty.

The primary object is to qualify the student by systematic and standard methods of training for reserve officers.

## REGISTER OF STUDENTS.

ALTSHULER, JOSEPH A. ....	Iowa Falls, Iowa
ALVEY, GLENN H., B.A., Univ. of California .....	Beaumont, Texas
AMSHIEL, MILTON L. ....	Pittsburgh, Pa.
ANTHONY, WALTER G. ....	Pittsburgh, Pa.
AUCHMUTY, R. LAIRD .....	Crafton, Pa.
BARAN, GEORGE .....	Cleveland, Ohio
BARTH, WILLIAM A. ....	Aspinwall, Pa.
BACHELOR, GUY F. ....	Edgewood, Pa.
BECKTEL, SAMUEL E. ....	Uniontown, Pa.
BELL, FRED R. ....	Pittsville, Pa.
BENDER, ARTHUR J. ....	Sharpsburg, Pa.
BERNARD, RUDOLPH .....	Pittsburgh, Pa.
BIXBY, ARTHUR B. ....	Sewickley, Pa.
BOLLINGER, PARK G. ....	Altoona, Pa.
BOWEN, JOHN W. ....	El Dorado, Kansas
BOWSER, CHARLES W. ....	Johnstown, Pa.
BROCK, FAY F. ....	Canonsburg, Pa.
BROWN, JOSEPH B. ....	Greensburg, Pa.
BROWN, LAWRENCE R. ....	Pittsburgh, Pa.
BURKHOLDER, KENNETH J. ....	Buffalo, N. Y.
BURNS, ALVIN G. ....	Tulsa, Okla.
BUTLER, THOMAS .....	Pittsburgh, Pa.
BUTTERMORE, PAUL M. ....	Wilkinsburg, Pa.
CAMPBELL, R. DUDLEY .....	Pittsburgh, Pa.
CARL, HERMAN L. ....	Williamstown, Pa.
CARNER, JOHN J. ....	Marietta, Ohio
CHAO, P. H. ....	Pai, Wu-Chang, China
CHRISTOPHER, CHARLES F. ....	McClellandtown, Pa.
CLARK, JOHN W. ....	Pittsburgh, Pa.
CLEMENS, JOHN I. ....	Pittsburg, Kansas
CRAIG, ROBERT J. ....	Yatesboro, Pa.
CUNNINGHAM, CHARLES S. ....	Bellevue, Pa.
DAVIS, WILLIAM S. ....	Philadelphia, Pa.
DAY, JOSEPH F. ....	Farrell, Pa.
DEEGAN, CHARLES J. ....	Pittsburgh, Pa.
DEL CAMPO, RENE C. ....	Havana, Cuba
DODWORTH, J. RUSSELL, JR. ....	Pittsburgh, Pa.
DOROZYNSKY, THEOPHILE .....	Pittsburgh, Pa.
DUNBAR, JAMES C. ....	Pittsburgh, Pa.
DYER, WILLIAM B. ....	Ben Avon, Pa.
ECKENRODE, CHARLES A. ....	Saltsburg, Pa.
ECKERT, FRANK E. ....	Ridgway, Pa.

EDGAR, ALEXANDER W. .... Wilksburg, Pa.  
 EDKINS, LEROY C. .... Johnstown, Pa.  
 EDWARDS, FLOYD E. .... Marietta, Ohio  
 EHRHARDT, C. H. .... Bellevue, Pa.  
 FENNELL, RAYMOND D. .... Salina, Pa.  
 FLEMING, EDWARD F. .... Pittsburgh, Pa.  
 FOSTER, ALDEN W., PH.B., Yale Univ. .... Pittsburgh, Pa.  
 FOX, GEORGE C. .... Ellicottville, N. Y.  
 FOX, ROBERT W. .... Altoona, Pa.  
 FRICK, DARRELL C. .... Pittsburgh, Pa.  
 FUKUDA, HIDEO, LT., Naval Engineering College, Japan  
 ..... Hiroo, Tokyo, Japan  
 GOLDISH, SAMUEL S. .... Marietta, Ohio  
 GRAHAM, ALMON J. .... Buffalo, N. Y.  
 GREEN, HENRY Y. .... Pittsburgh, Pa.  
 GREENWOOD, CHESTER, B.S., Univ. of Nevada .... Vallejo, Calif.  
 GRIFFITH, WILLIAM J. JR. .... Pittsburgh, Pa.  
 GRIM, HOWARD G. .... Homestead, Pa.  
 HADFIELD, IRA C. .... Pittsburgh, Pa.  
 HAHN, RAYMOND R. .... Barnes, Pa.  
 HALL, GEORGE W. .... Tulsa, Okla.  
 HANN, W. .... Mt. Morris, Pa.  
 HARTNETT, MICHAEL J. .... Johnstown, Pa.  
 HEFES, JACOB M. .... Homestead, Pa.  
 HERRICK, RALPH .... Pittsburgh, Pa.  
 HOWE, A. BUDROW .... Buffalo, N. Y.  
 HOYT, DOUGLAS G. .... Syracuse, N. Y.  
 HUNTLEY, STIRLING .... Pittsburgh, Pa.  
 HUTCHISON, JAMES P. .... Butler, Pa.  
 IRVIN, ROBERT W. .... Pittsburgh, Pa.  
 JOHNSON, CHARLES J. .... Mahaffey, Pa.  
 JONES, FRANK .... Scranton, Pa.  
 JONES, MARSHALL J. H. .... Pittsburgh, Pa.  
 JORDAN, LLOYD G. .... Punxsutawney, Pa.  
 KERNAN, EUGENE F., A.B., Rock Hill College .... Baltimore, Md.  
 KEZER, ROLAND W. .... Woodsville, N. H.  
 KINGSBURY, CARL O. .... Newcastle, Pa.  
 KORNFELD, SAMUEL .... Tulsa, Okla.  
 KRAUS, WILLIAM A. .... Pittsburgh, Pa.  
 KRUSE, WILLIAM C. .... Buffalo, N. Y.  
 LAIRD, WILLIAM J. .... Munhall, Pa.  
 LEE, IEE TUNG .... Wongchow, Hupeh, China  
 LEWIS, WILLIAM E. .... Pittsburgh, Pa.  
 LEY, HERBERT L. .... Aspinwall, Pa.  
 LOUGHREY, D. RIPLEY .... Connellsville, Pa.  
 LOUGHREY, JAMES D. .... Connellsville, Pa.  
 LUTZ, GEORGE A. .... Pittsburgh, Pa.  
 MCCABE, ARTHUR L. .... Coraopolis, Pa.

McCAFFERTY, LAWRENCE M. ....	New Bethlehem, Pa.
McCLINTOCK, CHARLES B. ....	Oil City, Pa.
McCORMICK, JOSEPH W. ....	Quebec, Canada
McDONALD, EDWIN C. ....	Duquesne, Pa.
McFADDEN, JOHN U. ....	Philadelphia, Pa.
McFARLANE, MAX. ....	Timblin, Pa.
McGUIGAN, ROBERT I. ....	Pittsburgh, Pa.
McQUEEN, NEIL. ....	Toronto, Canada
MALLOY, VINCENT F. ....	Newcastle, Pa.
MILLER, GEORGE H. ....	Pittsburgh, Pa.
MITCHELL, JAMES. ....	Reynoldsville, Pa.
MOONE, J. RUSSELL. ....	Butler, Pa.
MURPHY, JOHN C. ....	Pittsburgh, Pa.
NELSON, JEAN O. ....	Sterling, Colo.
NEUENSCHWANDER, PAUL. ....	Sistersville, W. Va.
OLIVER, DONNELL N. ....	Pittsburgh, Pa.
PATTERSON, WALTER M. ....	Freeport, Pa.
PAYNE, DONALD W. ....	Marietta, Ohio
PETERS, R. G. BENARD. ....	Tarentum, Pa.
POISTER, FRED D. ....	Ellwood City, Pa.
PRICE, EARL M., CAPT., U. S. Military Academy. ....	Racine, Wis.
PRINTZ, JAMES S. ....	Pittsburgh, Pa.
REED, CHARLES A. ....	Pittsburgh, Pa.
RISACHER, FELIX E. ....	Verona, Pa.
ROBINSON, BRYAN F. ....	Greenville, Pa.
ROSSER, RICHARD. ....	Homestead, Pa.
ROTH, ERNEST E., B.S., Hiram College. ....	Pleasantville, Pa.
SCHAEFER, CARL E. ....	Pittsburgh, Pa.
SCHUCHA, ANDREW R. ....	Pitcairn, Pa.
SCHMERTZ, RALPH D. ....	Pittsburgh, Pa.
SCHWARTZMAN, LEON J. ....	Nashville, Tenn.
SENEFF, THOMAS E. ....	Pittsburgh, Pa.
SHAW, THOMAS A. ....	Pittsburgh, Pa.
SHEA, LAWRENCE L. ....	Somerville, Mass.
SHIARELLA, NICHOLAS W. ....	New Kensington, Pa.
SIMPSON, CHARLES P. ....	Woodlawn, Pa.
SKIRVIN, ORREN W. ....	Oklahoma City, Okla.
SMITH, EARL H. ....	Marietta, Ohio
SPEAR, HOWARD G. ....	Marietta, Ohio
STADTFIELD, JOSEPH R. ....	Pittsburgh, Pa.
STALLARD, DEAN. ....	Eastland, Texas
STALEY, CLAIR H. ....	Pittsburgh, Pa.
STAUFF, J. LAUER. ....	Pittsburgh, Pa.
STEELE, WILLIAM A. ....	Pittsburgh, Pa.
STRAITIFF, CORSEY H. ....	Punxsutawney, Pa.
TAYLOR, J. CLYDE. ....	Wilkinsburg, Pa.
THAETE, EDWARD H. JR. ....	Philadelphia, Pa.

THOMSON, EDWARD W. ....	Pittsburgh, Pa.
TROXELL, JOHN N. ....	Ridgway, Pa.
TWEEDY, JOSEPH L. ....	Knickerbocker, Texas
UPHAM, HARRY R. ....	Mt. Vernon, Ohio
WALDO, KENNETH C. ....	Oil City, Pa.
WALKER, DONALD E., B.A., Oklahoma Univ. ....	Norman, Okla.
WALKINSHAW, JOHN R. ....	Johnstown, Pa.
WEISE, PAUL H. ....	Bridgeville, Pa.
WENDELN, BERNARD ....	St. Marys, Ohio
WIBLE, JAMES P. JR. ....	Kittanning, Pa.
WICHUM, CARL G. ....	Altoona, Pa.
WIGHTMAN, ALEXANDER M. ....	Pittsburgh, Pa.
WIKOFF, ALAN H. ....	Pittsburgh, Pa.
WILLIAMSON, RAYMOND R. ....	Friendly, W. Va.
WITTMER, GEORGE ....	Glenshaw, Pa.
WOODSIDE, ROBERT A. ....	Munhall, Pa.
WOOTTON, GEORGE H. ....	Pittsburgh, Pa.
WYLIE, JAMES R. JR. ....	Wilkinsburg, Pa.
YESTER, CHARLES ....	McKeesport, Pa.
YOST, KENNETH B. ....	Pittsburgh, Pa.
ZIEMAN, JOHN R. ....	Toronto, Canada
ZWINGGI, FRANK V. ....	Pittsburgh, Pa.

In attendance Summer Term only:

CLINGAN, JOHN R. T. ....	Niles, Ohio
KUO, NAN ....	Meng Tsing, Honan, China
WEST, SAMUEL B. ....	Pittsburgh, Pa.



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